Background material for presentation on EFH and Corals
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NMFS and the AFSC are responsible for managing and studying both deep-sea coral ecosystems and essential fish habitat (EFH) under the 2006 reauthorization of the MSA. Deep sea coral and sponge ecosystems are widespread throughout most of Alaska's marine waters. In some places, such as the western Aleutian Islands, these may be the most abundant cold-water coral and sponge communities in the world. The challenges facing management of deep coral and sponge ecosystems in Alaska begin with the lack of knowledge of where these organisms occur in high abundance and diversity. Regional maps of coral distributions are needed to implement spatial management measures and to determine where deleterious interactions with fisheries and other human activity might occur.

Coral Focus
The objective of the coral research presented here was to provide model-based maps of the distribution of deep-sea corals for three Alaska ecosystems (Gulf of Alaska; GOA, eastern Bering Sea; EBS and the Aleutian Islands; AI). Through groundtruthing activities using underwater imagery, we collected further information on coral density, size structure and diversity. These models and data were then compared to the spatial distribution of fishing activity.

The data used for the deep-sea coral modeling was from AFSC's bottom trawl survey database. Environmental correlates also included some model derived variables (such as ROMS outputs), as well as bathymetry and bathymetry-derived products. Models were produced on a 100 m x 100 m grid. The groundtruth data were stereo imagery collected at 468 transects in the EBS and AI.

The trawl and imagery data were acquired using standard sampling protocols (stratified random allocation). The trawl survey data and habitat data are part of ongoing stock assessment and oceanographic studies, so these have established data management strategies. The imagery data collection is relatively novel, so strategies are being developed to manage these data.

All trawl survey data and bathymetry data are publicly available through the AKFIN database and from the RACE website. Model outputs and image data are/will be available from the deep-sea coral program data portal.

We produced model based maps of coral distribution and abundance, and then overlaid these maps with the distribution of fishing effort. These analyses were provided to the NPFMC, where they were used to inform decision-making about whether spatial fisheries closures should be implemented in two canyons in the EBS. The NPFMC requested the analysis, providing the basis for inclusion into management.

For the EBS canyons coral model, extensive public outreach over 4 years was provided to stakeholders, partners, managers and the public through face-face meetings, seminars, public presentations, media interviews, etc. The results of the studies were peer-reviewed both for scientific journals and as part of the NPFMC process. The AI and GOA coral models have been presented publicly, but with a lower profile and delivered to the AFSC.

EFH Focus
The Alaska Regional Office, with the assistance of the AFSC is required to define EFH for all federally managed fish and invertebrate species by life history stage from reproductive habitats to adult feeding habitats. In Alaska EFH was initially defined using distribution data where available, such as historical catches from bottom trawl surveys or fisheries observers. These definitions were considered level 1 (presence or absence). Many species and life history stages had "undefined" EFH descriptions. EFH descriptions are reviewed every 5 years and it is expected that new information will be incorporated into EFH descriptions.

The objective of the EFH research presented here was to provide maps of the distribution of EFH for three Alaska ecosystems (Gulf of Alaska; GOA, eastern Bering Sea; EBS and the Aleutian Islands; AI) based on species distribution modeling. The species descriptions were expanded to include all seasons and all life history stages were there was available data. We also sought to elucidate relationships of species with their environment through the modeling.

Similar to the deep-sea coral models, the data used for the EFH modeling was from AFSC's bottom trawl survey database. However, additional data from fisheries observers that occurred in seasons outside of summertime and catches of early life history stages from the FOCI program were also used. Environmental correlates also included some model derived variables (such as ROMS outputs), as well as bathymetry and bathymetry-derived products. Models were produced on a 100 m x 100 m grid. Three types of models were used, generalized additive models, hurdle models, and maximum entropy models.

The trawl data were acquired using standard sampling protocols (stratified random allocation). The fisheries observer data were considered as presence only data and were collected off of commercial fishing vessels. The early life history data was also considered as presence only, since many of these data have been collected as part of smaller studies over the years that may have had differing sampling techniques and equipment. All of these data are part of ongoing stock assessment and oceanographic studies, so these have established data management strategies. .

All trawl survey data and bathymetry data are publicly available through the AKFIN database and from the RACE website. The model outputs were made available to the public, managers and stakeholders through the AFSC FTP site and a series of draft NOAA technical memoranda.

We produced model based maps of species distribution and abundance for over 400 species-season-life history stage. These models are being used to refine EFH descriptions for

all FMP species. These analyses were provided to stock assessment authors and the NPFMC. The AK regional office requested the analysis, providing the basis for inclusion into management.

Communication to stakeholders, partners, managers and the public has taken place through seminars, public presentations and a workshop. The results of the studies were peer-reviewed both for scientific journals and as part of the NPFMC process.

The major strength of the approach to coral and EFH research at the AFSC, is that we are responsive to requests from management and generally funding is available to provide the data and analyses needed. We have good relationships, access and mechanisms for outreach and the NPFMC, industry and NGO's in the region are generally very engaged in the process.

The major weakness of the AFSC approach is that we have so far been unable to identify directly how reductions in EFH and/or coral directly affect fish populations or productivity. This has in part led to the lack of a coherent index of the "health" of EFH and coral that can be annually monitored and updated. Additionally, outreach and funding for projects that are not a high management priority may not be available. EFH and coral research often receive a relatively low ranking on the AFSC science priorities list, but a high probability of funding, creating a bit of a mismatch between the two. For the center, this means that staff primarily participate in more important research (such as supporting stock assessment), while EFH and coral research is ancillary to their main duties.

Links to supporting materials and publications
Corals:
http://www.afsc.noaa.gov/techmemos/nmfs-afsc-313.htm

http://www.npfmc.org/bering-sea-canyons/

https://deepseacoraldata.noaa.gov/

Rooper CN, Sigler M, Goddard P, Malecha PW, Towler R, Williams K, Wilborn R, Zimmermann M (in press) Validation and improvement of species distribution models for structure forming invertebrates in the eastern Bering Sea with an independent survey. Mar. Ecol. Prog. Ser.

Sigler, M.S., Rooper, C.N., Hoff, G.R, Stone, R.P., McConnaughey, R.A. and T. K. Wilderbeur. 2015. Faunal features of submarine canyons on the eastern Bering Sea slope. Mar. Ecol. Prog. Ser. 526:21-40.

Rooper, C.N., M. Zimmermann, M. Prescott, A. Hermann. 2014. Predictive models of coral and sponge distribution, abundance and diversity in bottom trawl surveys of the Aleutian Islands, Alaska. Mar. Ecol. Prog. Ser. 503:157-176.

EFH:

http://npfmc.legistar.com/gateway.aspx?M=F&ID=a3960a7a-d238-4bd6-b9ca-c4271a3896ca.pdf

http://npfmc.legistar.com/gateway.aspx?M=F&ID=2be9538f-6fa6-4c36-b008-b351b000a086.pdf

http://npfmc.legistar.com/gateway.aspx?M=F&ID=eb1c074c-23c9-458e-8a79-4bb95a61214b.pdf

http://npfmc.legistar.com/gateway.aspx?M=F&ID=2b614b5d-3f8d-4bdc-a3c6-6eb1e2cf0e35.pdf